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Sustainable agriculture and rural development*

Report of the Secretary-General

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I. Introduction

1. In accordance with the multi-year programme of work for the Commission on Sustainable Development, adopted by the General Assembly at its nineteenth special session, in 1997 (see General Assembly resolution S-19/2, annex), the Commission will consider at its eighth session the topic of agriculture as an economic sector. While the particular focus for the review is chapter 14 of Agenda 21 (Promoting sustainable agriculture and rural development), the Assembly called on the Commission to undertake an integrated discussion from the broad perspective of sustainable development, highlighting the linkages between economic, social and environmental objectives. The present report has been prepared with this approach in mind by the Food and Agriculture Organization of the United Nations (FAO), which serves as Inter-Agency Committee on Sustainable Development (IACSD) task manager for chapter 14 and other related chapters of Agenda 21. The report is supplemented by three addenda, dealing, respectively, with urbanization and sustainable agricultural development, biotechnology for sustainable agriculture, and the linkages between agriculture, land and water. The report of the Secretary-General and its addenda under the agenda item "Integrated planning and management of land resources" (E/CN.17/2000/6 and Add.1-4) are also highly relevant to the discussion. In addition, a background paper on the changing patterns of livestock production has been prepared by FAO for the Commission's consideration. Another background paper which summarizes the high-level consultation on rural women and information organized by FAO in October 1999 is also before the Commission.

2. The year 2000 offers the third opportunity for the Commission to review land and agriculture issues since the 1992 United Nations Conference on Environment and Development (UNCED). It may be useful to recall that at the third session of the Commission, in 1995, the Commission noted with concern that even though some progress had been reported, disappointment was widely expressed at the slow progress in moving towards sustainable agriculture and rural development in many countries.[1] At the fifth session of the Commission, which was then followed by the five-year review undertaken by the General Assembly in 1997, member States urged that sustainable food security for both the urban and rural poor be made a policy priority. They stressed the importance of implementing the commitments of the Rome Declaration on World Food Security and the World Food Summit Plan of Action, adopted by the World Food Summit (Rome, 1996), especially the call for a minimum target of halving the number of undernourished people in the world by the year 2015.[2]

3. Like earlier reports prepared by FAO for the Commission in 1995 and 1997, the present report includes a stock-taking of available information on the extent to which sustainable agriculture and rural development policies, strategies and programmes, as outlined in chapter 14 of Agenda 21, have been adopted. In addition, it also examines how this progress has helped to promote agriculture as an economic vehicle for attaining the major objectives of sustainable agriculture and rural development and the World Food Summit Plan of Action in the post-UNCED period. It examines the degree to which potential gains from the agricultural sector can be realized in the context of overall development objectives, focusing on three major dimensions of sustainable agriculture and rural development: economic, social and environmental. The report also highlights the special features of agriculture, including its contribution to the economy as a whole and its place in the fabric of rural life. In this connection and to better understand the benefits of agriculture that extend beyond primary food production, the Government of the Netherlands and FAO co-sponsored a conference on the multifunctional character of agriculture and land (Maastricht, 12-17 September 1999) as an inter-sessional input to the eighth session of the Commission. The report of the Chairman of the Maastricht conference is before the Commission as document E/CN.17/2000/_.

II. Sustainable agriculture, food security and economic development

A. Trends in agricultural production and food security

4. FAO's latest provisional estimates indicate that world agricultural production (crop and livestock) in 1998 stagnated at the same level as in 1997, making this the only year in the decade of the 1990s in which no expansion in output occurred. Production is

estimated to have declined in both developed and developing regions; for the latter countries, this marks the worst performance year since 1989. Table 1 shows the annual percentage change in production from 1991-1998 (provisional), according to the regional groupings used by FAO.[3]

5. Among the developing countries, the most important factor behind the slowdown was a sharp decline in production in the Far East and Oceania region, including, among the largest producers, China, India and the Philippines, caused by a variety of weather problems (heavy rains and floods and El Niño-related droughts). Bad weather, including two serious hurricanes, also disrupted agricultural production in Latin America and the Caribbean, while unfavourable weather conditions as well as continuing civil strife affected production in sub-Saharan Africa for the second consecutive year (although a slight gain from a sharp decline in 1997 is indicated). Only in the Near East and North Africa group did agricultural production increase to any extent in 1998, more than recovering from a major downturn the year before.

6. Among developed countries, crop and livestock production declined significantly in several countries of the Commonwealth of Independent States (CIS), while it declined slightly in the countries of Eastern and Western Europe. North America, Australia, New Zealand and Japan posted, on balance, small gains.

7. As table 1 also shows, the global stagnation in agricultural production estimated for 1998 compares unfavourably with an average annual rate of growth of 2.2 per cent over the 1994-1998 period, during which developing countries' output gains significantly outpaced that of developed countries. In fact, only in sub-Saharan Africa did the growth in average annual agricultural production over the 1994-1998 period fail to exceed population growth. But even with overall production gains throughout the decade, the number of countries facing serious food shortages numbered 37 in 1998 and 1999, and it has been necessary for FAO's Special Relief Operations Service to intervene in 64 countries over the last two years.[4]

8. A major new publication by FAO, *The State of Food Insecurity in the World, 1999*, presents updated data on the number of people experiencing hunger and examines the reasons behind this. The most recent estimates indicate a continued decline in the number of hungry people living in developing countries, from 830 million for the period 1990-1992 down to around 790 million in 1995-1997.[5] Tables 2 and 3 show the estimated undernourished population over a nearly 30-year time span, disaggregated according to the FAO regional groupings, in both percentage and absolute terms. It is noteworthy that while the absolute number of hungry has declined or shown fluctuating movement in most developing regions, the figure for sub-Saharan Africa has been consistently rising. And in contrast to the other regions, the percentage share of population undernourished in sub-Saharan Africa has barely changed over the past 26 years.

9. *The State of Food Insecurity in the World, 1999*, also estimated, for the first time, the extent of hungry people in the developed countries, grouped into industrialized countries and countries with economies in transition; these figures are shown in table 4. While the total number of undernourished is estimated to be 34 million, amounting to 3 per cent of the population, it is clear that the bulk of this figure and of its increase since the beginning of the decade is due to growing hunger in the transition economies.

10. The latest FAO data show a decline of 40 million in the number of hungry people living in developing countries between 1990-1992 and 1995-1997, averaging out to about 8 million fewer hungry a year. This is a larger yearly drop than measured in earlier periods and is encouraging news. Nevertheless, the figure must be kept in perspective vis-à-vis the total number of undernourished people in developing countries of around 790 million. FAO has determined that the average annual decrease needed to reach the World Food Summit target is nearly 20 million or two and one half times more than the current figure. It is of great concern that progress to date in reducing hunger has led to the conclusion in late 1999 — only three years after the Summit — that the central goal of reducing by half the number of undernourished people in the world by the year 2015 will not be met unless significant policy changes occur.[6]

B. Macroeconomic policy reforms and agricultural trade liberalization

11. The overall statistics cited above should not negate the fact that significant progress in overcoming hunger and poverty has been made in individual countries and regions and at local levels over the past two decades. Successful examples show that hunger

can be eliminated, with the right policies and measures that promote sustainable agriculture and support comprehensive rural development schemes that, *inter alia*, improve access to land, combat poverty, create employment and reduce rural emigration. The international community has committed itself to these goals in its adoption of Agenda 21 and the World Food Summit Plan of Action, as well as in the final agreements of other recent conferences in the economic, social and environmental areas.

12. With these commitments in mind and faced with the impact of related international agreements, such as the Uruguay Round of multilateral trade negotiations,[7] Governments have undertaken an ongoing process of policy reforms that have facilitated progress towards the objectives of sustainable agriculture and rural development. In developing countries, past macroeconomic policies have largely discriminated against the agricultural sector, both directly, through disproportionately low allocation of public funds, export taxes, low collection prices by parastatals, export bans and impediments to free internal flows of goods, and indirectly, through overvalued exchange rates and the relative protection given to other sectors — mainly manufacturing — plus an overall urban bias. Unfortunately, international markets for agriculture remain highly distorted, limiting the economic benefits that could accrue to agriculture in developing countries as a result of trade liberalization, and hindering progress on other aspects of sustainable agricultural and rural development.

13. On the issue of policy reforms related to agricultural trade liberalization, a recent study carried out by FAO in 16 developing countries on the implementation of the Agreement on Agriculture and other Uruguay Round agreements affecting agriculture revealed that none of the countries had to reformulate their domestic policies in order to comply with the general provisions of or with their specific commitments under the Agreement. For most of them, the reform process under the Agreement was a continuation of earlier reforms already adopted under structural adjustment programmes, regional agreements or unilateral liberalization programmes. Two other agreements concerning foodstuffs were reached in the Uruguay Round: the Agreement on the Application of Sanitary and Phytosanitary Standards and the Agreement on Technical Barriers to Trade. These agreements are strongly influencing national and supranational agricultural policy designed to limit obstacles to trade in the form of unjustifiable protectionist measures related to food safety and food quality. International support to assist developing countries in becoming informed and equal partners in trade negotiation has been forthcoming. FAO has provided assistance to member countries in reviewing their current food and agricultural policies in relation to those agreed under the World Trade Organization (WTO) and in preparing for the new round of negotiations. Concerning agricultural trade and related issues, six agencies (WTO, the United Nations Conference on Trade and Development (UNCTAD), the International Trade Centre (ITC), the World Bank, the International Monetary Fund (IMF) and the United Nations Development Programme (UNDP)) are promoting an Integrated Framework Initiative for providing trade-related assistance to the least developed countries.

14. As part of the implementation of the World Food Summit Plan of Action, 150 country strategies for national agricultural development plans have been prepared, at FAO's initiative, with a view to enlisting the partnership of the United Nations system and other development agencies and promoting investment in agriculture. Regional strategies and programmes for agricultural development and food security are being prepared concurrently.

15. In most developed countries, reforms in agro-environmental policy measures are making a major contribution towards promoting sustainable agricultural and rural development. The 15 members of the European Union have formulated "Agenda 2000", which aims at integrating environmental goals into the common agriculture policy. In the United States, major provisions were made in the 1996 Farm Bill to strengthen the Conservation Reserve Program aimed at reducing soil erosion and water pollution. In Canada, a sustainable development strategy entitled "Agriculture in harmony with nature: strategy for environmentally sustainable agriculture and agri-food" was formulated in 1997. The Organisation for Economic Cooperation and Development (OECD) countries as a whole accorded priority to improving the environmental performance of agriculture, appropriately managing land and other natural resources, and addressing public concerns related to the safety of food throughout the agri-food chain.

16. In developing countries, recent agricultural sector policy reforms may be generalized to include providing a stable legislative framework, which guarantees ownership of and access to productive resources, especially land; improving the functioning of markets (including for labour and credit); sanctioning of property rights; and creation of risk-reduction mechanisms. Major policies and programmes have mainly been focused on food security concerns, rural development programmes, and development of natural resources management plans. More specific examples are:

- In Africa, major efforts on sectoral policy reforms and strategies for promoting food security and rural development have contributed towards the deregulation of commodity imports, agriculture diversification, the development and adoption of comprehensive rural development strategies and the generation of rural employment opportunities through privatization of agro-industries. In addition, national environmental action plans developed with assistance from the World Bank focus on controlling desertification, sustainable management of forestry resources, improvements in soil fertility conditions and agriculture diversification;
- In several countries of the Latin America and Caribbean region, a growth-oriented economic environment and a macroeconomic and sectoral framework favourable to rural development are being introduced with technical assistance from the Inter-American Development Bank and the World Bank. Strategic options being considered include fostering human capital development and the creation of permanent rural jobs through public investments geared to conserving and restoring natural resources;
- In South-East Asia, where the recent economic crisis has been most severe, a plan of action on rural development and poverty eradication was jointly developed at the Sixth Association of Southeast Asian Nations (ASEAN) Summit, held in December 1998 at Hanoi;
- In South Asia, with technical assistance from the Economic and Social Commission for Asia and the Pacific (ESCAP), a multi-year project on sustainable agricultural development strategies is being implemented in several countries. Similar exercises have been completed in four Pacific island least developed countries.

17. In general, it may be said that the impact of economy-wide policy reforms and agriculture trade liberalization has been to place farmers in a better position to invest in land improvement. However, there is still a considerable challenge to be faced in integrating both economy-wide and agriculture sectoral policies and strategies in pursuit of sustainable agriculture and rural development.

C. International cooperation related to food and agriculture

18. Estimates for 1998 indicate that official development assistance (ODA) from OECD member countries to developing countries and multilateral development agencies rose to $51.9 billion, reversing several years of decline. The fall-off in the late 1990s had been so sharp, however, that ODA flows remain about the same now as they were in 1980 (measured in 1995 US$). Measured in constant prices, ODA provided to the agricultural sector has been steadily declining since the late 1980s and throughout the 1990s, amounting to only $7.5 billion (1995-1997 average), or 14 per cent of total ODA, compared to nearly $15 billion, or 25 per cent of ODA, 10 years before (1986-1988 average).[8]

19. While private sector investment in agricultural research has risen during the 1990s, this overwhelmingly remains in the developed countries. Moreover, distribution of foreign direct investment (FDI), which has increased significantly to developing countries during the last decade, is highly uneven and directed mainly outside the agricultural sector. The overall result has been to reduce the total volume of resources flowing to agricultural development in general and to the achievement of sustainable agriculture and rural development objectives in particular. The worst affected sub-sectors are those not directly involved in agricultural production. These include some agro-industries, inputs to manufacturing, regional and river basin development, and rural development. FAO has estimated that the combined reduction experienced by these sub-sectors between 1990 and 1997 was 46 per cent.

20. The five-year review of implementation of Agenda 21 carried out in 1997 urged Governments and

the international community to continue or increase investments in agricultural research and to assist developing countries, in particular those with high population densities, to gain access to the results of such research and to technology aimed at improving agricultural productivity in limited spaces. Several global initiatives have sought to compensate for the reduction in assistance to the agricultural sectors of poor countries, including the United Nations Special Initiative for Africa (UNSIA) and the United Nations Development Assistance Framework (UNDAF). In addition, renewed efforts are under way by donors to boost their support to the Consultative Group on International Agricultural Research (CGIAR), which faced a serious funding crisis in the mid-1990s. More than 50 countries, private foundations, and international and regional organizations contribute to the CGIAR system, a network of 16 international agricultural research centres, including 13 located in developing countries. The "third system review" of CGIAR, completed in October 1998, concluded that the system would need resources of about $400 million a year (up from $345 million in 1998) to support an expanded and reoriented research agenda which focuses on sustainable agricultural development.[9]

III. Agriculture and social development

A. Poverty alleviation

21. As stated in the Rome Declaration on World Food Security, poverty is a major cause of food insecurity and sustainable progress in poverty eradication is critical to improve access to food.[10] The World Bank estimates that about 1.5 billion people suffer from poverty — defined as living on less than $1 per day — and if recent trends persist this figure could rise to 1.9 billion by 2015. Even though there have been some successes in reducing poverty levels in certain developing country regions, the continued increase in overall population levels is raising the absolute number of the poor. Moreover, the gap between rich and poor countries is increasing, as is the marginalization of the poor in general and poor women in particular.

22. Poverty is linked with many serious social inequalities which contribute to hunger and malnutrition. Of the 4.4 billion people living in developing countries, it is estimated that nearly three fifths lack basic sanitation; a third have no access to clean water; a quarter lack adequate housing; and a fifth have no access to modern health services.[11] Sickness and disease adversely affect agricultural production in the poorest areas, which depend on human labour for much of the work. Women and children are more likely than men to be living in poverty. Other vulnerable groups, including indigenous populations, are also disproportionately affected by poverty. In countries afflicted by high rates of human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), many in sub-Saharan Africa, agricultural output has been severely affected by the impact on rural workers.

23. In addition to the continuing pressures of population growth — estimated to increase from 6 billion people in 1999 to around 7.5 billion in 2020 — a further factor in analysing the social dimensions of hunger and poverty is the growing rate of urbanization, particularly in the developing countries. Nearly 60 per cent of the world's population are expected to be living in urban areas in 25 years, of whom approximately 90 per cent will be in developing countries. The World Bank has examined various national policies aimed at discouraging rural-urban migration and concluded that the best approach might be for Governments to pursue development policies that benefit both urban and rural areas.[12]

24. In urban areas of low income countries, agriculture is developing as an informal activity practised by poor and landless city dwellers. In many countries, urban and peri-urban agriculture also includes intensive and well-managed production by commercial enterprises. Both contribute significantly to food security, employment and improved livelihood in cities. Other rural-urban linkages related to agriculture, food consumption patterns, commercialization, gender issues and financial flows are addressed in more detail in addendum 1 to the present report.

25. A review by FAO of structural and institutional reforms that have been initiated in many poorer areas highlights the role of local institutions in mitigating, transforming and responding to macroeconomic changes affecting rural economies and rural households, including female-headed households. Several Governments, in cooperation with multilateral and bilateral agencies, are engaged in designing policies and launching programmes and projects for poverty alleviation in rural areas with the broader

strategic objective of ensuring sustainable livelihoods. The experience gained in these activities is being analysed and shared among United Nations organizations, such as FAO, the World Food Programme (WFP), the International Fund for Agricultural Development (IFAD) and UNDP. An inter-agency programme led by FAO is focusing on rural household income strategies and their interaction with the local institutional environment. The programme aims to identify constraints and biases against the rural poor and promote the development of those institutions or organizations that may specifically benefit the income-earning efforts of poor households.

B. Decentralization and institutional reforms

26. The ongoing institutional and related legal reforms, as well as the parallel evolution of land tenure systems, support achievement of sustainable agriculture and rural development objectives. These reforms are considered necessary for enhancing community and private sector participation in overall economic development, for the stimulation of private investment in agriculture and for the reduction of social disparities, including gender disparities.[13] Governments and international organizations are increasingly involved in institutional capacity-building, particularly at local level. Due to the political nature of institutional policies, however, this reform process has often been extremely slow and its effects on the sustainability of the agricultural sector are yet to be felt in many areas.

27. The 1990s have witnessed a growing trend in many countries towards partnerships between the public and private sectors and organizations of civil society in the accomplishment of common tasks. Experience has shown that the state should provide an enabling institutional and regulatory environment for agricultural and rural development, and does not necessarily have to be involved in the provision of all services previously considered to be exclusively in the public sector domain. Some of these services may be performed more cost effectively by the private or non-governmental sector, through a system of sub-contracting and other forms of cooperation. This reform can often be combined with incentives to enhance the capacity of the private sector and non-governmental organizations to provide services from which the state has disengaged, or for which civil society has a strong comparative advantage.

28. Many developing countries, particularly in West and North Africa, Latin America and more recently in South-East Asia, are engaged in designing comprehensive programmes in the context of World Bank agricultural sectoral loans, including institutional reforms. Farmers' organizations, including cooperatives and professional bodies, are being established or strengthened with a view to providing complementary services at local level and participating in policy debate with decentralized public institutions.

29. Such countries as Hungary, Poland, Romania and Lithuania are now elaborating ways of developing more appropriate, market-responsive local institutions to help fill the institutional gap created by the transformation of centrally planned agricultural production systems into market-driven mechanisms. In some countries, the development of new legal frameworks for promoting the establishment of member-controlled and financed agricultural cooperatives is helping to improve the provision of essential services to farmers.

30. There is also a growing interest in the promotion of a variety of more decentralized, locally financed and market-oriented institutional mechanisms to support farmers in sharing information and collaborating on sustainable natural resource management and rural development issues. These issues were discussed at a technical consultation on decentralization for rural development in late 1997, co-sponsored by FAO, IFAD, the World Bank and the German and Swiss development cooperation agencies. Follow-up activities have been undertaken in a range of countries, including Senegal, Mali, Morocco, Bolivia, Viet Nam and Cambodia.

31. The role that local organizations can play in partnership with government is also receiving increased attention at the national level as regards disaster prevention and preparedness. The need for promoting more decentralized and locally controlled institutional mechanisms for managing environmental risk and responding to rehabilitation requirements, was further highlighted by the problems experienced in the aftermath of recent severe hurricanes in Central America.

C. Evolution of land tenure structures

32. Inadequate land tenure structures are still a major obstacle to sustainable agriculture and rural development in many countries. In particular, women's access to land remains an unresolved issue in a number of cases. Since UNCED, however, there have been considerable developments in the role of land tenure institutions. These changes have been taking place in three parallel (although often uncoordinated) processes:

(a) Land tenure regularization with the development of integrated cadastre, land property registries and land information systems;

(b) The growing involvement of land-users and other stakeholders in the use of such systems for land tenure regularization and planning;

(c) The application of these methods beyond private lands for the regularization of user rights and the sustainable use of communal lands.

33. With these three major developments, land tenure reform and regularization have become important policy tools for building sustainable land management and land administration in rural areas. These land use trends are further analysed in the report of the Secretary-General on integrated planning and management of land resources (E/CN.17/2000/—), which also contains examples of their impact on promoting sustainable agriculture and improving the utilization of land resources in both developed and developing countries.[14]

IV. Agriculture and the environment

34. Most of the priority issues contained in chapter 14 of Agenda 21 relate to the sustainable management of basic natural resources for agriculture and the use of agro-chemicals and other technologies that affect these resources. In reviewing progress made in 1997, the Commission highlighted the problems of continuing land degradation and the need to follow up the World Food Summit objectives in these areas. The Commission also emphasized the importance of accelerating the implementation of the plan of action of the Leipzig International Conference on Plant Genetic Resources and the essential need for furthering agricultural research and technology transfer. Recent progress on all these aspects is reported below. In addition, new developments related to the impact of urbanization on agriculture; agro-biotechnology; and water for agriculture, are reported here and further elaborated in the addenda to this report. Also, the report of the Secretary-General and its addenda dealing with land issues is highly relevant to the subject.

A. Combating the degradation of agricultural lands

35. Degradation of agricultural land and decline in soil fertility continue to be major threats to food security and sustainable development, especially in developing countries. The problem is most severe in sub-Saharan Africa, where annual average nutrient loss is estimated to be around 24 kilograms (kg)/hectares (ha) and is increasing. In the South Asia region alone, the cost of different forms of land degradation is estimated to be US$ 10 billion per year using the production loss approach. These estimates illustrate the severity of the present problem and indicate the huge future cost of land degradation in the absence of effective land rehabilitation and conservation measures.

36. In parallel with further surveys and assessments of land degradation at the national, regional and international levels, many Governments and international institutions, such as the International Fund for Agricultural Development (IFAD) and the World Bank, are addressing the degradation problem in the context of integrated land use planning and management operations and as an integral part of programmes and projects for land conservation and sustainable agriculture development. The focus of the latter is on rehabilitation and improvement of land resources and on land management practices with multiple benefits, such as zero-tillage.

37. The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, which entered into force in December 1996 and has been ratified by over 150 countries, has focused efforts on the formulation of national action programmes aimed at preventive and remedial measures to enable those living in the world's drylands to improve their productive capacities in agriculture and livestock.

B. Integrated plant nutrition systems

38. UNCED, in chapter 14, recommended the promotion of IPNS (using balanced supplies of plant nutrients from organic, biological and chemical sources) as a means to overcome the excessive use of mineral fertilizers and/or of livestock wastes in intensive production systems, causing, *inter alia*, water pollution by nitrates, and as a way of reducing the cost of maintaining soil fertility in less intensive systems. Progress has been slow. Water pollution by nitrates is increasing in many countries, causing eutrophication in lakes, estuaries and coastal areas. Continuous soil nutrient depletion without adequate replenishment, such as through the use of fertilizers and other practices, leads to the deterioration of soil productivity and threatens the sustainable production of agriculture and food security. In general, past programmes proposed more self-reliant plant-nutrition strategies but failed to consider links to the cycling and use of organic materials that the farmers have access to. In addition, soil and water management aspects have not been integrated or addressed adequately. To rectify this, FAO in collaboration with the World Bank, the CGIAR system and other stakeholders have formulated a soil fertility initiative for sub-Sahara Africa. The partner organizations are currently assisting 14 countries in preparing their national action programmes for soil productivity improvement, taking a holistic approach, including crop, soil, water, nutrient and pest management. Private sector institutions and NGOs are also actively involved in this programme.

39. In order to facilitate adoption of integrated soil and nutrient management, FAO during the last three years initiated a number of collaborative programmes with the national agricultural research systems in more than 15 developing countries on integrated soil and nutrient management practices, including sponsoring farmers field schools. As peri-urban agriculture is gaining importance and vast resources of organic wastes are not adequately exploited for profitable use in agriculture, urgent attention is also required to promote the best methods of composting and recycling them safely.

C. Control of pests and diseases

40. Recent developments in this field are in line with UNCED commitments and show significant progress in three directions: the development of regulatory frameworks; the extension of international cooperation dealing with emergencies; and the expanded use of integrated pest control methods.

41. The International Plant Protection Convention, an international treaty administered by FAO, is concerned with invasive plant species and pests. It has as its main purpose the securing of common and effective action to prevent the introduction and spread of pests of plants and plant products and to promote measures for their control. The Convention covers all plants, including the wild flora and all pests including weeds. The Convention was amended in 1997 to include recent developments in establishing standard-setting procedures, including institutional arrangements. The development and adoption of standards are facilitated by the secretariat of the Convention, while the necessary institutional arrangements and procedures for the development and adoption of international standards are under the authority of the Commission on Phytosanitary Measures.

42. The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in 1998 to reduce the availability of pesticides that can cause devastating problems to human health and the environment. The Convention will enter into force once 50 countries have ratified it. Governments have agreed to continue to implement a voluntary PIC procedure using the new procedures of the Convention until the Convention formally enters into force. UNEP and FAO have been assigned the responsibility for providing the secretariat of the Convention.

43. In 1994, FAO established an emergency prevention system for transboundary animal and plant pests and diseases in order to minimize the risk of such emergencies developing and affecting food security, farm income and the environment. Regarding livestock, the programme provides for early warning and early reaction to threats of epidemics, and is an essential component of the wider ongoing efforts to respond to the accelerating demand for meat and milk in developing countries and to the growing role of livestock in sustainable agriculture and rural development. It works in partnership with global and regional organizations, including the World Health Organization (WHO), the Organization for African Unity (OAU), the International Atomic Energy Agency (IAEA), the European Community (EC) and several

bilateral donors. It aims at the eradication of transboundary diseases, such as foot-and-mouth disease and rinderpest, which render the animal products from a number of developing countries untradeable.

44. Migratory pest control often relies heavily on the wide use of pesticides. This has raised many environmental and human health concerns. Through the collaborative EMPRES locust programme, affected countries, donors and FAO aim to reduce pesticide use and optimize control measures through the improvement of early warning, early reaction, the promotion of research and implementation of environmentally friendly control methods. Outbreaks, such as that which developed in the countries bordering the Red Sea in 1997-1998, have been brought under control through this programme before they develop into a plague and extend to other countries and regions.

D. Integrated pest management

45. Pesticide use continues to increase in developing countries, but in many developed countries it is falling gradually from very high levels. New product development has contributed to this reduction by providing new compounds with low application rates. Integrated pest management aims to reduce the negative impact of crop protection measures on the environment and human health. The initial focus of integrated pest management was on rice production in Asia, but it has spread to a variety of crops in a growing number of countries. Integrated pest management programmes across Asia continue to develop through community empowerment and policy reform in a wide range of crops, including vegetables and cotton on which the largest amounts of pesticides are being used. Better informed Asian urban consumers now demand pesticide-clean produce, and this has given further impetus to integrated pest management in a number of Asian countries.

46. In some African countries, parastatals, such as cocoa boards, cotton companies and development boards, are among the promoters of integrated pest management programmes to implement pest management practices that will complement new pesticide residue limits being enforced in importing countries. New programmes have evolved from integrated production and pest management approaches that also focus on production technologies and soil fertility issues as well as integrated pest management. There has been a significant sharing of expertise across the southern and eastern Africa region, especially with support from the Zimbabwe integrated production and pest management programme.

47. In the Middle East, integrated pest management programmes are being developed, with national and bilaterally assisted programmes showing positive results on fruits and vegetables. In Latin America, existing programmes are expanding taking the Asian experience into account. A number of national programmes in developed countries also promote integrated pest management, particularly on fruit trees and vegetables. The use of sterile male techniques, such as those promoted by the joint FAO/IAEA programmes in this field, provides an important contribution to the eradication campaigns of pests such as fruit flies and to avoidance of widespread applications of pesticides.

E. Agro-biodiversity and genetic resources

48. It is important that recent international agreements have recognized that biodiversity created over millennia by agriculture needs to be protected and used for development. The Convention on Biological Diversity has helped to focus attention on the very important issues associated with genetic resources for food and agriculture, and urged complementary programmes in this area with FAO. For its part, FAO has continued its follow-up activities to the Leipzig International Conference on Plant Genetic Resources, held in 1996, and has expanded its programme on animal genetic resources; both these activities are carried out under the policy guidance of FAO's intergovernmental Commission on Genetic Resources for Food and Agriculture (CGRFA).

49. The 161-member CGRFA is currently negotiating the revision of the International Undertaking on Plant Genetic Resources, in collaboration with the Convention on Biological Diversity, *inter alia*, for the realization of an agreement on farmers' rights (as requested in Agenda 21), as well as access to plant genetic resources for food and agriculture, including *ex situ* collections not addressed by the Convention. The Commission also monitors the implementation of the rolling global plan of action on plant genetic resources for food and agriculture, adopted by the Leipzig Conference. As part of this monitoring process, a series

of regional review meetings were convened in 1998 to promote and facilitate implementation of the plan by countries and major stakeholders.

50. There has also been substantial progress in strengthening of national genetic resources programmes, and in setting up regional and crop networks, to promote links between conservation and use. With support from the Global Environment Facility (GEF) and the United Nations University (UNU) and in collaboration with national organizations, FAO is developing participatory and sustainable models of *in situ* agrobiodiversity management programmes. The World Early Warning and Information System on Plant Genetic Resources for Food and Agriculture has also been strengthened.

51. In 1999, CGRFA and its subsidiary intergovernmental Technical Working Group on Animal Genetic Resources endorsed the FAO global strategy for the management of farm animal genetic resources, aiming to promote their conservation and sustainable utilization. The strategy supports the development and use of critical technologies for effective conservation and sustainable use, including indigenous technologies and appropriate biotechnologies. There remains a need for Governments and the international community to make available the financial resources and develop the capacities necessary to respond to the need for sustainable intensification of animal production systems, and to overcome the increasing rate of genetic erosion. FAO estimates that 800 of 2,000 breeds at risk have been lost this century, and 30 per cent of those remaining risk disappearing within a generation. CGRFA also agreed that FAO should coordinate the preparation of a country-driven report on the state of the world's animal genetic resources.

F. Organic farming[15]

52. Grass-roots organizations, farmers and traders are now engaged in a worldwide movement in favour of organic food and fibre production. In European countries, organic farming occupies 6 to 10 per cent of arable lands, and organic management covers a significant part of diverse systems, such as pastures in New Zealand, cereals in North America, coffee in Mexico and cotton and bananas in several African countries. As a result, while representing around 1 per cent of the world food market, production and consumption of certified organic products continues to grow at about 20 per cent per annum. Organic agriculture can link food production, income generation and environment protection requirements by making maximum use of local knowledge, biodiversity, on-farm resources and biological control of pests and avoiding the use of agro-chemicals. The approach is receiving an impetus with the withdrawal of government subsidies on agricultural inputs, the introduction of favourable policy instruments, and growing concerns for food safety and environmental protection. These factors have provided new market opportunities, including exports by developing countries.

53. Two important events likely to support even greater acceptance and development of organic agriculture occurred recently. In January 1999, the FAO Committee on Agriculture, representing 115 member Governments, reviewed recent progress in this area and directed the organization to develop a coherent programme on organic agriculture. It was requested to take a stronger role in the development of organic agriculture, in collaboration with national programmes and other partners, such as the International Federation of Organic Agriculture Movements.

54. A second major development was the approval by the joint FAO/WHO food standards programme of the Codex Alimentarius Commission, of guidelines for the production, processing, labelling and marketing of organically produced foods. These standards are essential to promote the development of national legislation, encourage international trade and provide consumer confidence in certified organic products.

G. Other developments

55. Some ongoing initiatives aim at meeting several of the objectives of sustainable agriculture and rural development and the World Food Summit action plan through improvements of the farming system as a whole. Several comprehensive programmes on sustainable farming systems are being promoted by national authorities in developed and developing countries, by regional and international institutions and NGOs. Some of these focus both on sustainability and food security objectives. An important example is the FAO-initiated special programme on food security, which was endorsed by Heads of State and

Governments during the 1996 World Food Summit. The participatory, country-driven programme aims at assisting low-income food-deficit countries in improving their national food security. It is currently operational in over 50 countries through the mobilization and training of local personnel and farmers involved in pilot projects. Phase I combines the sustainable intensification of crop production systems with small-scale irrigation and water control and diversification in small animal production, including apiculture, aquaculture and artisanal fisheries. Field activities serve as a basis for a participatory approach to the analysis of socio-economic constraints, such as land tenure, inputs, technology, markets, credit and for policy and institutional reforms. While the programme's focus is on addressing food insecurity problems in poverty-prone areas, action is not limited to working on production constraints and opportunities. It also stresses issues of equity (including gender problems), and access to food through such actions as those that promote agriculture-based rural employment. The programme is promoting exchange of knowledge and experience between developing countries through its South-South cooperation initiative, under which more advanced developing countries send field technicians and experts to specific recipient countries for two or three years, during which they live with the rural communities involved in the programme. Phase II of the programme, the macroeconomic phase, consists of assistance to Governments to prepare a food security and agricultural policy programme and an investment programme, and the preparation of feasibility studies of bankable projects. Various financial institutions, such as the World Bank, the African Development Bank and the Islamic Development Bank, UNDP and diverse bilateral donors have already joined in the partnership.

56. Rural energy supply is another issue requiring attention. In most developing countries, the majority of the rural population is dependent on traditional fuels, such as wood, dung and crop residues. Rural energy policies and programmes have been effected in only a few countries, and the intensity of effort is still much below the scale of needs. According to a recent study by FAO and the World Energy Council, only 33 per cent of the rural population in developing countries today have access to electricity. Although globally the number of rural households with access to electricity doubled from 610 million in 1970 to 1.4 billion in 1990, this increase barely kept pace with population growth.[16] The rural energy transition required to enhance productivity — as outlined under sustainable agriculture and rural development — was still to take place. Three technologies have, however, advanced considerably in terms of both cost and reliability: wind power generation; photovoltaic cells; and bioenergy conversion. All three are being promoted in Europe, the United States and selected developing countries, including Argentina, Brazil, Cape Verde, China, India, Mexico and Zimbabwe.

V. Challenges and options for further action

57. As described in chapter 14 of Agenda 21, the major objective of sustainable agriculture and rural development is to increase food production in a sustainable way and enhance food security. Following on this, world leaders at the 1996 World Food Summit pledged their political will and common and national commitment to achieving food security for all and to an ongoing effort to eradicate hunger in all countries, with an immediate view to reducing the number of undernourished to half their current level no later than 2015.[17] This challenge was given high priority by the General Assembly when it reviewed developments relating to agriculture in 1997. As evidenced in the most recent FAO publications, the current pace of progress towards meeting this goal is uneven and insufficient, and expectations are that it will not be reached. There are no simple solutions to the complex problems and challenges of eliminating hunger, but rather a range of policies, methods and tools which can be used in different mixes in order to fit the diversity of production and consumption patterns in agriculture. Such diversity can itself be an essential component of sustainability.[18] Despite this complexity and diversity, a basic three-prong approach may be discerned, involving: (a) an accelerated increase in the amount of food to be produced and traded; (b) giving a fair share of resources to agriculture and rural area development; and (c) a major effort in raising the income level of the poor.

58. Implementation of the 12 inter-linked programme areas contained in chapter 14 and realization of the full potential contribution of sustainable agriculture and rural development to economic development will still take several years. Seven years after UNCED and three years after the Rome Declaration, most issues and

challenges outlined in previous progress reports are still outstanding. Environmental problems, such as land degradation, loss of agro-biodiversity and the impact of climate change on agriculture, pose an increasing threat to the ability of nations to meet their growing food needs while simultaneously improving the quality of life of rural people. Although the review of recent developments contained in the present report could not cover all the issues related to sustainable agriculture, certain themes and challenges have emerged which require the highest priority. Most of these have been identified above and most concern the following two fundamental questions related to sustainable agriculture and rural development:

- How to accelerate progress in reducing the number of poor and improving household food security without further degrading natural resources?
- How to cope in sustainable ways with the multiple stresses imposed by consumers on agriculture as a result of population growth, rising incomes, urbanization, demands for higher food quality and safety standards and growing environmental concerns?

59. In considering the twin challenges outlined above, the report has highlighted the need for innovations and adjustments in the following priority areas, which are briefly described below:

(a) Sustainable intensification;

(b) Vertical and intersectoral integration;

(c) Agricultural trade liberalization;

(d) Emergency preparedness;

(e) Information, participation and empowerment;

(f) Resource flows and financing mechanisms;

(g) Improved policies and programmes.

Sustainable intensification

60. A recent study assessing world food prospects in the next two decades has concluded that the world's farmers will have to produce 40 per cent more grain in 2020 to feed a growing population.[19] The production increases required to improve food security and to meet the needs and changing demand patterns of a growing and increasingly urbanized population will have to result mainly from intensification of agricultural production — either in the form of higher yields or through increased cropping intensity. However, growth in cereal yields, both in developed and developing countries, has been declining since the "green revolution" of the 1970s. Higher yields will depend on an increased priority being accorded to investment in primary agriculture and upon the agricultural research and extension system making a wide range of modern technologies accessible. But although partial intensification of agriculture has already been achieved in many regions, the sustainable intensification of agriculture without further degradation of natural resources and environment still remains a challenge.

Vertical and intersectoral integration

61. Application of existing knowledge to reduce the yield gap between current production levels and potential thresholds can only be effected if rising productivity is stimulated by suitable price incentives arising from efficient markets for inputs and agricultural produce. Increasing supplies of agricultural products will help to support economic growth and generate employment in high potential rural areas and high population areas near urban centres through vertical integration of production systems, leading to increases in value added before produce reaches the ultimate consumer.

62. Conversely, the full benefit of higher productivity will only be felt by consumers if it is accompanied by increases in marketing efficiency at each point in the supply chain. Addressing consumption patterns and the distribution of benefits and ensuring food safety along all links of the food production and processing chain should form part of a wider agricultural development and food security strategy. Input and output linkages to other sectors — especially the non-farm rural sector — have also proved to be critical in ensuring agricultural development and viability and in offering additional employment and income-earning opportunities to rural people. The promotion of agro-industries and closer economic integration with fisheries, forestry and tourism are therefore of great importance.

Agricultural trade liberalization

63. Despite some progress in reducing trade-distorting policy, support and protection to agriculture is still high in many developed countries and adversely affect agriculture in other countries by depressing commodity prices, which undermines investment in the

sector. While net food-importing countries have benefited from the surpluses, over the longer term the access to cheaper imports has led to reduced support for domestic agriculture in public policies. The remaining distortions have mostly negative consequences for non-subsidizing exporting countries, including developing countries. Reduction of support and protection in higher-income countries, including the reduction of export subsidies, could make a significant contribution to both agricultural trade and to many other aspects of sustainable agriculture and rural development.

64. A major challenge faced by developing countries is to meet internationally accepted requirements related to the sanitary and phytosanitary standards agreement of the Uruguay Round of trade negotiations. That agreement and the technical barriers to trade agreement contain promises of financial and technical assistance for developing countries. Making these promises concrete would be one issue to pursue. The private sector should be enabled to assist developing countries in establishing adequate facilities and procedures for quality assurance. Improved dialogue between the main stakeholders concerning this topic is essential. New issues, such as state trading, competition policy, environmental considerations and labour standards, present a multitude of challenges to developing countries.

Emergency preparedness

65. The frequency of natural and man-made disaster-related emergencies in the agricultural sector is exacerbating problems of food insecurity, while simultaneously funds for pre- and post-emergency food assistance to developing countries are declining. A broader and more concerted effort of risk minimization and contingency planning is required. This should cover both agricultural systems themselves and the related systems involved in input supply, output processing and marketing.

66. To this end, it would be advantageous to streamline, link together and enlarge the many existing early warning and monitoring systems, and also to broaden the scope of food security vulnerability mapping so as to identify and better assess the risks, the bottlenecks, and their causes. Here again, the full information and participation of agricultural producers should be ensured, as they should be the prime beneficiaries and main actors in taking protective precautionary measures and developing collective insurance schemes. The development of "safety nets" in case of economic crises brought about by macroeconomic instability appears to be an effective means to tackle the food security problem in the short term. Such provisions could also prove to be useful for creating synergies with longer-term elements essential to a sound development strategy, such as investment in human and physical capital and efforts to increase agricultural productivity.

Resource flows and financing mechanisms

67. There is a need for increased ODA, especially to the least developed countries, to assist in providing these basic facilities in the rural areas. While this would require a reversal of recent trends, FDI has been increasing rapidly and its broader distribution and application to developing countries is of vital importance for the attainment of sustainable agriculture and rural development objectives. Despite the dramatic rise in FDI compared to trends in ODA, most of the benefits have been concentrated on very few countries. It is necessary to explore ways to attract these investments to a wider range of developing countries and to develop modalities for ensuring that a larger share is channelled to agriculture and to rural areas in general. Potential synergies between public and private investments in agriculture and rural areas need to be re-examined. However, private investments can only be attracted if adequate levels of public goods — including infrastructure and other measures to promote easy access to markets — are provided.

68. Governments can directly increase resource flows to rural areas through domestic resource mobilization resulting from reforms to existing subsidy and tax regimes; they can also enhance the efficiency of resource use. This could entail reforming current tax systems, full-cost pricing of natural resource services, curtailing unproductive expenditures, reducing subsidies and unnecessary military expenditures. These changes require strong government commitment, institutional reforms and a system of good governance.

69. Possible innovative financing mechanisms include compensating farmers for the global benefits they generate through conserving agro-biodiversity, reducing greenhouse gas emissions and increasing carbon sequestration. Attracting FDI through a clean development mechanism under the current structure of the Kyoto Protocol (or remodelling it to match the twin

objectives of increasing carbon sequestration and improving food security) could provide an opportunity to narrow the investment gap resulting from decreased ODA. Increased investments in efficient use of renewable energy resources in the rural areas could also be a part of this mechanism.

Information, participation and empowerment

70. There is a need for increased access to modernized information technology for capacity-building and for making farmers better informed about practices, prices and access to inputs and output markets. Empowerment of local communities through enhanced knowledge and access to information, new skills, and greater capacity to plan and manage their affairs — backed by institutional reforms including strengthened governmental implementation processes and budgetary management — are vital to the success of sustainable agriculture and rural development and the World Food Summit Plan of Action. The importance of active participation of farmers in producer associations, field schools and other local community groups involved in sustainable intensification and diversification processes has been amply demonstrated. Improvement programmes must go beyond the usual fields of agricultural education and training to cover the management of farmers associations, their interactions with public administration and private sector, and their role in policy making and planning. While better distribution of knowledge and information is essential for achieving sustainable development, including sustainable agricultural development, there is reason to be optimistic that the next decade will witness more rapid progress in reaching sustainable agriculture and rural development goals, based upon improved knowledge management and access to information leading to greater transparency and better cooperation.

Improved policies and programmes

71. Success in any one of the above priority areas, which are determining progress towards meeting the objectives of sustainable agriculture and rural development and the targets of the World Food Summit, depends upon the existence and application of appropriate policies. Finding appropriate mechanisms to enhance cooperation among stakeholders in sustainable agriculture and rural development is of vital importance since insufficient coordination in programme efforts is putting a strain on both human and financial resources, especially at the national level but also within the international development community.

72. Although some progress has been made at the national level towards improving individual policy measures and developing better programmes for natural resources management, rural development and poverty alleviation, the challenge of designing and effectively implementing complementary policies within different national authorities still remains. Macroeconomic balance and economic stability alone are not sufficient to foster growth in rural areas. Success depends on a conducive policy environment that can deliver increasing agricultural investment, promote natural resource conservation, and enhance human and physical infrastructures that enable all stakeholders to contribute to sustainable agriculture and rural development goals.

73. There is a need to identify areas where policy integration is particularly lacking and to develop ways for successfully promoting such integration at the national level. Policies also need to address a number of microeconomic and other structural reforms in order to minimize any negative impacts of macroeconomic policy changes including:

- Investments in rural infrastructure, agriculture research, human capital and educational development in the rural areas, which do not normally attract private sector investment;
- Economic incentives for sustainable intensification of resource rich areas and enhancement of soil fertility in resource poor areas;
- Removing perverse subsidies that are promoting inefficient energy use in agriculture;
- Reallocation of property rights between public, communal and private ownership; and more equitable sharing of available resources and opportunities in favour of the rural population in general and the rural poor in particular.

Table 1

Annual changes in crop and livestock production, 1991-1998

(Percentage change over previous year)

Region	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Average 1994-98*
World	**0.4**	**2.2**	**0.6**	**2.9**	**2.1**	**3.7**	**2.4**	**0.0**	**2.2**
Developed countries	**-2.9**	**0.8**	**-4.0**	**0.9**	**-1.8**	**3.0**	**1.2**	**-1.3**	**0.4**
North America	-0.4	7.7	-7.8	14.5	-4.7	4.6	2.8	0.8	3.6
Western Europe	0.6	1.1	-3.1	-1.1	-0.1	4.2	-0.1	-0.4	0.5
Eastern Europe	-1.9	-5.8	1.2	-8.4	4.6	-1.2	1.6	-0.8	-0.9
CIS	••	••	-3.9	-14.4	-4.3	-3.3	0.4	-10.8	-6.5
Australia, New Zealand and Japan	-1.0	3.1	-1.2	-1.0	3.5	3.6	1.8	0.3	1.6
Developing countries	**3.0**	**3.4**	**4.0**	**4.3**	**4.7**	**4.2**	**3.1**	**0.8**	**3.4**
Sub-Saharan Africa	6.0	0.2	3.5	3.2	3.4	5.6	-0.4	0.7	2.5
Far East and Oceania	2.8	4.4	5.8	4.7	5.3	3.9	4.4	-0.3	3.6
Latin America and the Caribbean	2.8	1.2	0.3	4.7	4.9	1.8	3.0	2.5	3.4
Near East and North Africa	2.5	3.4	1.3	0.9	1.0	10.3	-3.5	6.6	3.1

Source: FAO, "The state of food and agriculture", document C99/2, submitted to the FAO Conference, thirtieth session, Rome, 12-23 November 1999.

Note: Two dots (••) indicate that data are not available or are not reported separately.

Table 2
Percentage of population undernourished in developing regions, 1969-1971, 1979-1981, 1990-1992 and 1995-1997

Region	Percentage undernourished			
	1969-71	1979-81	1990-92	1995-97
Sub-Saharan Africa	34	37	35	33
Near East and North Africa	25	9	8	9
East and South-East Asia	43	29	17	13
South Asia	38	38	26	23
Latin America and the Caribbean	19	13	13	11
All developing regions	**37**	**29**	**20**	**18**

Source: Same as table 1.

Table 3
Number of undernourished people in developing regions, 1969-1971, 1979-1981, 1990-1992 and 1995-1997

Region	Number of undernourished (million)			
	1969-71	1979-81	1990-92	1995-97
Sub-Saharan Africa	89	126	164	180
Near East and North Africa	45	22	26	33
East and South-East Asia	504	406	283	241
South Asia	267	338	299	284
Latin America and the Caribbean	54	46	59	53
All developing regions	**960**	**938**	**831**	**791**

Source: Same as table 1.

Table 4
Percentage and number of undernourished people in industrialized countries and countries with economies in transition, 1990-1992 and 1995-1997

Category	Percentage undernourished		Number of undernourished (million)	
	1990-92	1995-97	1990-92	1995-97
Industrialized countries	1	1	9	8
Countries in transition	5	6	20	26
All developed regions	**2**	**3**	**29**	**34**

Source: Same as table 1.

Notes

[1] See *Official Records of the Economic and Social Council, 1995, Supplement No.* (1995/), para. 205.

[2] See *Report of the World Food Summit (13-17 November 1996), Part One* (Rome, FAO, 1997), appendix, World Food Summit Plan of Action, para. 7. "Hunger" and "undernourished" are often used interchangeably. "Food security" is a term to describe access to the food required for a healthy and productive life; it is often considered at the household level.

[3] See FAO, "The state of food and agriculture", document C99/2 submitted to the FAO Conference, thirtieth session, Rome, 12-23 November 1999, paras. 12-15.

[4] Ibid., paras. 15-17.

[5] See FAO, *The State of World Food Insecurity, 1999* (Rome, 1999). The report is available electronically at: http://www.fao.org/NEWS/1999/img/SOFI99-E.PDF. The figure published by FAO in 1996 for the World Food Summit was 840 million hungry people in developing countries (1990-92 average); this has subsequently been revised to 831 million as new information became available, with an estimated range of reliability of + or - 5 per cent.

[6] Ibid.; see also statement of the Director-General of FAO to the FAO Conference, 13 November 1999, and various FAO press releases.

[7] See *Legal Instruments Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, done at Marrakesh on 15 April 1994* (GATT publication No. GATT/1994-7).

[8] See OECD, *Development Cooperation Report* (Paris, 2000); and FAO, "The state of food and agriculture",

loc. cit.; and International Food Policy Research Institute, *World Food Prospects: Critical Issues for the Early Twenty-first Century* (Washington, D.C., 1999).

[9] Consultative Group on International Agricultural Research, "Third system review" (October 1998), available at: http://cgreview.worldbank.org.

[10] See *Report of the World Food Summit* ..., para. 5.

[11] See World Bank, *Entering the Twenty-first Century: World Development Report 1999/2000* (New York, Oxford University Press, 1999).

[12] Ibid.

[13] See also report on a high-level consultation on rural women and information (Rome, 4-6 October 1999), background paper prepared by FAO for the eighth session of the Commission.

[14] See also the Bathurst Declaration and the report of a workshop on land administration for sustainable development (Bathurst, Australia, October 1999), submitted by the Government of Australia to the Commission at its eighth session (E/CN.17/2000/_).

[15] See also, on this topic, background paper entitled "Changing consumption and production patterns: organic agriculture".

[16] See FAO and World Energy Council, *The Challenge of Rural Energy Poverty in Developing Countries* (Rome, 2000).

[17] See *Report of the World Food Summit* ..., Rome Declaration on World Food Security, second paragraph.

[18] See also on this subject the diverse views recorded in the report of the Chairman of a FAO/Netherlands conference on the multifunctional character of agriculture and land (Maastricht, the Netherlands, 12-17 September 1999), submitted by the Government of the Netherlands (E/CN.17/2000/_).

[19] See International Food Policy Research Institute, op. cit.

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Sustainable agriculture and rural development

Report of the Secretary-General

Addendum

Urbanization and sustainable agricultural development*

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I. Introduction

1. Most of the world population growth in the coming decades will be in the cities of developing countries. These cities will therefore account for most of the increased demand for food. Urban populations, however, are not only consumers but also producers of food, especially high-value perishable agricultural produce. The growing urban populations and their demand for food and other agricultural products will also have major impacts on land use in peri-urban areas and nearby rural areas. The present addendum examines the impacts of urbanization on sustainable agriculture, including the issues of urban agriculture, the impact of cities on peri-urban areas and rural-urban linkages.

2. A majority of the population in North America and Europe have lived in cities since the early twentieth century, a majority in Latin America since the 1960s and a majority of people in West Asia since 1980. People in Asia and Africa remain predominantly rural but that situation is changing rapidly. Asian cities are growing at an average rate of 3 per cent per year, compared to overall population growth of 1.4 per cent, while the population of African cities is growing at a rate of 4 per cent per year compared to overall growth of 2.6 per cent. In both regions the majority of the population will live in urban areas by 2020. By 2025, approximately 60 per cent of the world's population will live in urban areas.[1]

3. In numbers, this translates into 4.7 billion people living in urban areas by 2025, an increase of 2.2 billion from 1995. That increase is almost all accounted for by developing countries, where an increase of over 2 billion people is estimated. In contrast, the world's rural population is projected to increase by only 190 million. The rural population in developing countries is projected to increase by 270 million, while that of developed countries is to decline by 80 million.

4. Urban population growth is a result of both natural population growth in the cities and rural-urban migration. Rapid rural-urban migration creates adjustment pressures in cities and rural areas, impacting on nearly all dimensions of development: health, education, communications, transport, water supply etc. Rural-urban migration results, in particular, in a loss of young and educated people in rural areas, but it also relieves population pressure on limited land resources and provides remittances for investment in agriculture and non-agricultural enterprises.

5. Urbanization also means changes in overall consumption patterns due both to increasing incomes (for those that have jobs) and to urban lifestyles. Relatively more meat, dairy products, wheat and fresh fruit and vegetables are consumed in urban centres, and there is an increasing demand for high quality, processed and convenience foods.

6. The urban population living in poverty has rapidly increased during the past two decades, along with rapid urbanization. The United Nations Centre for Human Settlements (Habitat) reported that in 1990, at least 600 million people in urban areas in Latin America, Asia and Africa were living in life — and health-threatening conditions. The additional 600 million people who would be added to urban populations in developing countries during the 1990s would increase the pressure on land, housing, water and sanitation, food supply and distribution systems, and education and health services, and would add to the urban population living in poverty.[2]

II. Urban agriculture

7. Urban agriculture provides a critical livelihood and source of food for many urban dwellers, particularly low-income households in developing countries. Urban agriculture, for the most part, is an informal activity practised by poor and landless city dwellers. It usually refers to small areas, such as vacant plots, gardens, verges, balconies and containers within the city used for growing crops and raising small livestock or milk cows, for family consumption or for sale in neighbourhood markets.[3] Peri-urban agriculture refers to farming near cities, generally intensive semi- or fully commercial production. Based on a combination of national census data, household surveys and urban research projects in a number of cities, it is estimated that at least one quarter and in some cases a much bigger percentage of urban and peri-urban households in developing countries are involved in agriculture (see COAG/99/10).

8. Urban agriculture provides non-market access to food for low-income families, and also creates agricultural jobs and incomes. Particularly in Africa, urban agriculture has played a crucial role in helping people cope with economic crisis. Even in high-income

countries, urban farmers contribute to supplies of fresh and organic products, and urban agriculture helps to maintain green space and provides leisure and sightseeing functions. In places where rural transportation infrastructure is poor or where agricultural market systems are inadequate, both urban and peri-urban agriculture fill critical food supply gaps.

9. There are, however, also negative aspects of urban agriculture. Agriculture often makes large demands on limited water resources, which have more economically valuable uses in urban areas, and inappropriate agricultural and aquacultural practices pose environmental and health risks, including unpleasant smells and noise. Intensive farming may also reduce environmental capacity for pollution absorption. These problems are commonly exacerbated by a lack of appropriate city planning and regulation of urban agriculture.

10. Four major issues relating to sustainable development of urban agriculture require attention:

(a) First, land-use planning and management systems should be developed to promote the use of land for the most productive sustainable use, including provision of environmental services, such as buffer spaces, run-off management and erosion control;

(b) Second, urban agriculture should be managed to minimize air and water pollution, including contamination of water supplies by nitrates and phosphates from fertilizers, and other undesirable environmental impacts;

(c) Third, urban agricultural practices should be managed to protect food safety and health by preventing contamination of food with excess pesticide and herbicide residues, heavy metals, pathogenic organisms and other toxic materials; in particular, there are high health risks associated with the use of untreated or improperly treated sewage water to irrigate crops, including infection from pathogenic micro-organisms and helminths (worms), such as *Ascaris* (nematodes) and *Ancylostoma* (hookworm). Recycled treated wastewater is a viable source of water for urban agriculture;

(d) Fourth, efforts should be made to recycle urban wastes for use in agriculture, through waste handling and treatment facilities for sewage, organic solid wastes and other wastes. Such recycling could provide employment opportunities as well as useful materials.

III. Agriculture and land use in peri-urban zones[4]

11. Urbanization has dramatic impacts on peri-urban zones, including on land use, the structure of family farms, the economies of farm households, production and marketing. Farmers adjust resource-use practices to increasing population densities and market opportunities. In most cases, urbanization initially leads to resource degradation in peri-urban zones due to increasing pressure on land resources. However, declining productivity often induces farmers to shift to forms of land use that are both more intensive and more sustainable. Such sustainable intensification has been observed in areas where urban conditions have existed over some time, for example around Kano in northern Nigeria. Peri-urban development generally includes economic diversification and expansion of agricultural post-production operations.

12. Four major issues relating to sustainable development of agriculture in peri-urban zones require attention:

(a) First, conversion of land from agricultural to non-agricultural uses should be managed to promote the conversion of land with marginal agricultural productivity and preserve the best agricultural land for agriculture, taking into account the need to manage water use for agriculture and competing uses;

(b) Second, advisory and support services should be provided to support a shift to sustainable intensive production for urban markets, and to develop agricultural processing enterprises and other non-farm employment opportunities;

(c) Third, critical forest areas around cities should be protected, and sustainable intensification of agriculture and agro-forestry should be promoted to meet urban demand for forest products and substitutes and reduce pressure on forest resources. This may require assessment of the economic, social and environmental costs and benefits of upward and outward growth of the city;

(d) Fourth, changes in plant and animal species composition associated with changing land use and intensified cultivation in urban and peri-urban zones

need to be assessed with respect to biodiversity. In the forest zone near Yaoundé, for example, dramatic changes have occurred in tree cover, vegetative species composition and wildlife.

IV. Rural-urban linkages

13. Urbanization has a major impact on rural agriculture, including on what is grown, how it is grown and the sustainability of production systems. Rural-urban linkages depend on historical, political, economic, cultural and ecological factors, as well as on the macro-level policy changes being implemented in many countries.

14. At least six rural-urban linkages require attention in planning for sustainable agricultural development. One is the increased competition for natural resources due to growing urban demand and the resulting resource degradation, even in areas far from urban centres. Marketing opportunities in urban centres are contributing to an expansion of the area under cultivation in rural areas. Since land resources are limited, increases in food supplies increasingly require productivity growth through the intensification of cultivation. Both the extension of cultivation into marginal lands and inappropriate intensification practices are contributing to resource degradation.

15. A second linkage is the role of urbanization as a catalyst for the commercialization of agriculture, which increases the use of fertilizers and other inputs, promotes rural non-farm enterprises, and increases urban-rural trade and other exchanges. Commercialization may also have important gender consequences since the commercialization of traditional staples has been associated in many areas with the increasing involvement of men in food crop production, particularly where there has been productivity enhancing technological change. This has reduced the incomes of women from selling surpluses from subsistence production. On the other hand, increasing commercialization is generally associated with increasing agro-processing, which provides new income opportunities for women. The balance between displacement from traditional roles and new opportunities determines who wins and who loses from rural development.

16. A third linkage is demand-induced commodity shifts in production. These commodity shifts, which lead to regional and subregional specialization, could be among the most important factors affecting the sustainability of agriculture in the coming decades. In humid zones of Africa, for example, the spread of fresh maize as an urban fast food is a pervasive trend. The preference of urban consumers for maize has contributed at least in part to the substitution of maize for sorghum and millet in the savannah areas of sub-Saharan Africa. In areas where such commodity shifts are taking place, the new dominant crops often have different production requirements, potential for land degradation and resilience in the face of climate variation.

17. In a number of areas, including West Africa and the Pacific Islands, urban demand for rice, which is not easily produced locally, places downward pressure on the prices of locally produced staples, such as root crops, millet and sorghum. That shift in consumption patterns also has an impact on rice-supplying areas. Due to relatively inelastic consumer demand, increased productivity as a result of technological change in recent decades has reduced commodity prices, benefiting urban consumers while leaving rural producers poor. Many rice producers are seeking to shift out of rice, with implications for the use of land a d water resources.

18. Urbanization also tends to shift consumption patterns towards horticulture crops, meat and dairy products. However, it is not clear how large that shift will be in the future since urban populations include larger numbers of poor people, who have different consumption patterns from the earlier, richer urban populations.

19. A fourth linkage is the impact of urbanization on rural labour supply. Urban industrialization and rural-urban migration may raise agricultural wages, increasing the demand for new agricultural technologies. Rural-urban migration has led to a "youth drain" in many rural areas, with impacts on agricultural labour productivity and rural social life.

20. Reduced labour availability in rural areas, particularly during peak seasons, is encouraging the adoption of labour-saving technologies, including agro-chemicals and machinery, which increases labour productivity but also carries risks to land and water resources unless appropriate technologies are used. Moreover, poorer rural households that cannot easily invest in labour-saving technologies will face even

greater problems unless there are compensating mechanisms available, such as labour-sharing and microcredit.

21. A fifth linkage is the food transportation, distribution and marketing systems for getting food to urban consumers. There are many inefficiencies and service breakdowns in supply channels to and within cities throughout the developing world. Wholesale and retail markets are often not well organized or managed, and market facilities are old, poorly maintained and too small to meet the needs of the growing population. Lack of efficient and reliable distribution channels imposes costs on urban consumers. There are also costs to the environment since more resources are used for production to make up for waste and losses in distribution systems.[5]

22. A sixth linkage is the financial flows between urban centres and rural areas. Urban-rural remittances are one of the most important sources of investment capital in rural areas. Individuals returning from the cities following retirement or short-term employment bring savings, which are another major source of capital for agricultural investment. Remittances are important for the daily subsistence of some rural dwellers, such as many households headed by women. They are also important for acquiring durable non-investment goods and community social infrastructure.

23. In the other direction, resource flows from rural areas to urban centres have historically been a significant source of investment capital and stimulus to growth and employment creation in urban centres, often at the cost of growth in rural areas. Policies and institutions affecting rural-urban resource flows will continue to have an impact on technological development and capital investment for both rural and urban agriculture.

V. Support for sustainable urban and peri-urban agriculture

24. Based on the importance of urban agriculture for household food security — particularly for low-income households — and its impact on the welfare of women, technical and financial support should be given to sustainable urban agriculture. Urban farmers need information about appropriate crops, fertilizers, pest control and water conservation practices in order to improve productivity while reducing pollution and degradation. Institutions and regulations are also needed to manage the use of public and private land for urban food production. Organic production technologies and other farming techniques with low environmental impacts should be promoted.

25. For peri-urban zones, support should be provided for sustainable production practices for the production of commodities to meet urban market demands. For this purpose, there is a need to support and build on the adjustments that are being made by farmers to ensure sustainability under intensification. While not all adjustments are optimal, they reflect the perceived opportunities and constraints of farmers.

26. For both urban and peri-urban agriculture, there is a need to monitor and assess the increasing competition between agricultural and non-agricultural uses of land, water and other resources, and how such competition and associated changes in resource costs are affecting resource use, production systems and food supply, as well as social stability.

27. In relation to rural-urban linkages, there is a need to assess emerging patterns of land use and production in response to urban demand. Increases in distribution and marketing efficiency are needed at each link in the supply chain, including further development of agricultural processing activities and commercial institutions. Support should also be provided for rural industries that complement sustainable agriculture and land use.

28. There is also a need to assess the extent to which urbanization is a cause of rural stagnation, as seen in much of Africa, and growing regional inequalities. In the light of such assessments, countries should develop integrated rural-urban strategies for sustainable agricultural development. This will require coordinated efforts at multiple levels, including at the levels of Governments, sectoral ministries, local authorities, community organizations, farmers and other concerned groups and individuals.

VI. Priorities for action

29. Meeting the food needs of rapidly growing urban populations is leading to pressure on agricultural systems and the environment. Small-scale urban agriculture, intensive commercial peri-urban agriculture, and strengthened and improved rural-urban linkages can all make important contributions to

meeting urban food needs. To ensure that those changes contribute to sustainable development will require adjustments in rural agriculture, improvements in distribution channels, dissemination of information on sustainable agriculture in different zones and technical assistance to farmers. Priority areas for action include:

(a) Strengthening capacity for land use planning in urban and peri-urban areas;

(b) Designing and implementing regional development plans for integrated urban and rural development;

(c) Strengthening extension and training services for urban, peri-urban and rural farmers in sustainable agricultural and resource management practices;

(d) Improving food distribution, storage and marketing systems, and promoting the development of agro-processing activities to meet the needs of growing urban populations;

(e) Improving the definition and administration of property rights to address conflicts over land and water use;

(f) Strengthening the capacity of public administrations, farmers organizations and other organizations to respond to new agricultural opportunities and problems resulting from urbanization through coordinated and cooperative efforts.

Notes

[1] See United Nations, *World Urbanization Prospects: the 1996 Revision* (Sales No.E.98.XIII.6).

[2] See United Nations, *An Urbanizing World: Global Report on Human Settlements 1996* (Oxford University Press, 1996).

[3] Urban agriculture also includes some intensive and well-managed production by commercial enterprises.

[4] "Peri-urban zones" are areas surrounding cities, which are in most ways integrated with the city. They extend as far as there is direct impact and influence of the urban centre, with greater population density, infrastructure and services than is generally found in rural areas. Depending on circumstances, a peri-urban zone can extend from the urban boundary to 50 or more kilometres from an urban centre.

[5] The issue of getting food into cities was identified and appraised as an emerging development priority in FAO document C.99/2, submitted to the FAO Conference at its thirteenth session, in November 1999.

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Sustainable agriculture and rural development

Report of the Secretary-General

Addendum

Biotechnology for sustainable agriculture*

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I. Introduction

1. Biotechnology is defined in article 2 of the Convention on Biological Diversity as any technological application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific uses. Agricultural biotechnology is a collection of scientific techniques, including genetic engineering, that are used to modify and improve plants, animals and micro-organisms for human benefit. It is not a substitute for conventional plant and animal breeding but can be a powerful complement. The present report explores what roles biotechnology may play in contributing to sustainable agriculture and rural development, with particular concerns for biosafety and biodiversity. It focuses on several major policy issues, presenting biological diversity as a source of raw product for crop and animal improvement, including the use of biotechnology. And it considers biosafety as a major domain for addressing the impact of biotechnologies on health and the environment. The report suggests policy issues that will need to be resolved by Governments if biotechnology is to contribute effectively to the food and livelihood security of developing countries in the next millennium.

2. The potential contribution of modern biotechnology to the achievement of global food security remains uncertain. While the application of agricultural biotechnology techniques can increase food security, most current agricultural biotechnology research lacks pro-poor objectives that could positively impact on sustainable agriculture and rural development objectives. The moral imperative for making modern agricultural biotechnologies, such as genetically modified (transgenic) crops, readily and economically available to developing countries who want them is compelling. There are a few research programmes that include biotechnologies that are designed to help developing countries to achieve food security, but additional resources are needed not only for the research efforts but also for effective mechanisms to ensure their safe utilization.

II. Agricultural biodiversity

3. Agricultural biodiversity encompasses the variety and variability of animals (including aquatic animals), plants, forestry and micro-organisms — at the genetic, species and ecosystem levels — necessary to sustain the key functions of the agro-ecosystem and its structure, as well as processes for and in support of agricultural production and food security. The biological resources contained within agricultural biodiversity are of direct and vital importance to the food security and socio-economic development of all countries.

4. The Conference of the Parties to the Convention on Biological Diversity, in its decision III/11, recognized the special nature of agricultural biodiversity, its distinctive features, and problems needing distinctive solutions. Indeed, many of the necessary institutional arrangements for promoting the conservation and sustainable use of crop, forest, farm animal and fish genetic resources are in place or under development, mainly within the Food and Agriculture Organization of the United Nations (FAO). These include:

- International legal agreements, such as the international undertaking on plant genetic resources;
- The intergovernmental Commission on Genetic Resources for Food and Agriculture;
- Global assessments and information systems, such as the domestic animal diversity information system;
- Internationally agreed plans of action, such as the global plan of action for the conservation and sustainable utilization of plant genetic resources for food and agriculture.

5. Agricultural biodiversity provides many ecological services within agro-ecosystems such as nutrient cycling, pest and disease regulation and pollination; these are outlined in an addendum to the report of the Secretary-General on integrated planning and management of land resources (E/CN.17/2000/6/Add.4). An understanding of the functions of biodiversity in agricultural systems will assist efforts to optimize the benefits from and minimize the risks of agricultural biotechnology.

6. FAO and the Conference of Parties to the Convention have continually promoted the development of national plans and strategies for the conservation and sustainable use of agricultural biodiversity. Because modern agricultural biotechnologies offer ways to improve and expand the sustainable use of genetic resources, they should be considered in any national planning regarding the sustainable use of agricultural biological resources in order to meet sustainable agriculture and rural development objectives.

III. Potential of biotechnology for sustainable agriculture and rural development

7. Agricultural biotechnologies have major potential for facilitating and promoting sustainable agriculture and rural development. They could also generate environmental benefits, especially where renewable genetic inputs can be effectively used to substitute for dependency on externally provided agrochemical inputs. The fact that genes or genotypes (e.g., varieties, breeds) can constitute locally renewable resources is of profound significance to the further development of sustainable agriculture and rural development. However, the power of modern biotechnologies to generate useful genotypes has not yet been harnessed for poorer farmers.

8. Nevertheless, the extent to which modern biotechnology will contribute to the achievement of food security for all is still an open question.[1] Science alone is unlikely to provide a complete solution to the problems of rural development. There are many processes, factors and socio-economic structures underlying poverty in rural areas, such as lack of access to land and other productive resources, low purchasing power, political powerlessness, fragile environments and distance from markets. Agricultural (or indeed plant biotechnology) research is but one factor which could impact on rural poverty; it is not a panacea for sustainable agriculture and rural development.

9. Comparative reviews of the state of agricultural biotechnologies in some developing countries have been carried out by the International Service for National Agricultural Research — Intermediary Biotechnology Service, a Consultative Group on International Agricultural Research (CGIAR) centre, and the Organisation for Economic Cooperation and Development (OECD), which concluded that the majority of developing countries have limited practical access to the tools and germplasm necessary to apply more sophisticated biotechnology research to their national needs. The barriers to such access are many and include lack of financial, scientific and infrastructural resources.

10. Biotechnology research has not been closely integrated with the problems and constraints confronting low-income farmers in the agricultural sector of developing countries. Biotechnology needs to be focused on some key problems within sustainable agriculture and rural development that historically have not been effectively addressed by conventional technologies.

11. Governments, scientists, non-governmental organizations, donors and CGIAR will have to consider the development of innovative mechanisms for the transfer of biotechnologies in developing country agriculture. Long-term public-sector funding will be necessary if the dissemination of agricultural biotechnology research is to benefit the poorer strata of society.

12. Over the longer term, there is little doubt that some biotechnological approaches to agricultural improvement could generate social, economic and environmental benefits if specifically targeted at the specific needs of poorer groups. While a vast range of approaches for the biotechnological improvement of such agronomic traits are either under study or in early development phases, given the current lack of focused public sector support for pro-poor agricultural biotechnology it is unlikely that poorer farmers will have economic access to such improvements in the short term.

13. Participation of poorer farmers and other stakeholder groups in developing sustainable agriculture and rural development is a key theme throughout Agenda 21. Greater impact of publicly funded biotechnologies on sustainable agriculture and rural development may result from including farmers' groups in decision-making regarding the definition of sustainable agriculture and rural development objectives that might be met by agricultural biotechnology. Communication channels and constructive dialogue between upstream public-sector

agricultural biotechnology researchers and downstream on-farm researchers and farmers' groups are poor. There are currently no mechanisms for effective translation of farmers' expressed needs into research action through appropriate "participatory problem transfer". Most public-sector bodies that either fund or conduct agricultural biotechnology research have no incentive mechanisms that would ensure that agricultural biotechnology research is targeted to the needs of poorer farmers or social groups. That is a public policy problem that can only be addressed by Governments and their institutions.

14. Agenda 21 proposes on-farm research in the development of non-chemical alternative pest management technologies. Biotechnology could contribute to the breeding of plant varieties or animal breeds tolerant to pests or pathogens that are currently controlled by agrochemicals, which could allow reductions in agrochemical use through the substitution effects of particular genes conferring tolerance.

15. Strategies for the sustainable use of genetic resources, such as resistance genes against pests or pathogens, are now emerging. The third CGIAR system review has proposed that CGIAR centres promote a global initiative for integrated gene management, which would, *inter alia*, promote more sustainable use of useful genetic resources.

16. A search through the scientific literature on biotechnology reveals a range of agricultural biotechnological research that could impact favourably on all of the priority areas of Agenda 21, chapter 14. However, the relevance of uncritically listing all biotechnology research which is under way and might meet sustainable agriculture and rural development objectives should be questioned. The development of a technology does not guarantee its widespread dissemination — especially to poorer social groups. When it comes to food security, it is the practical application of the research that matters, rather than the promise of the "pipeline" research orientation. The agricultural biotechnology research community lacks concrete examples of pro-poor applications of molecular-level biotechnology being put to use in farmers' fields on a scale necessary to have an impact on rural poverty.

17. Over the longer term, there is much promising agricultural biotechnological research that in theory might be harnessed for sustainable agriculture and rural development objectives, such as increasing yields and sustainable utilization of plant genetic resources for food including:

- Apomixis, an asexual technology of plant reproduction that can provide economic incentives to replant harvested seeds;
- Micropropagation and plant tissue culture technology (e.g., to generate disease-free plantlets of vegetatively propagated staple crops, such as cassava, potato, sweet potato, taro, bananas and plantains);
- Improved fermentation technologies;
- Improved technologies for generating biomass-derived energy;
- Generation of higher nutrient levels (e.g., pro-vitamin A, iron, essential amino acids) in nutrient-deficient staple crops, such as rice;
- Marker-assisted-selection strategies for improving agronomic traits in animal and plant varieties/breeds, including yield potential;
- Development of genotypes with abiotic stress tolerance (e.g., aluminium and manganese tolerant crops which can grow in acidic soils, salt tolerance, drought tolerance);
- Vaccines against animal diseases;
- Insect resistance;
- Bacterial, viral and fungal disease resistance;
- Better crop digestibility for animals and humans;
- Delayed overripening of fruits and vegetables (e.g., to reduce post-harvest losses).

18. Very few public-sector institutions or organizations are involved in the transfer of appropriate biotechnologies to the crops and farming systems of rural groups in developing countries, reflecting the current bias in agricultural biotechnology research to commercial markets. Internationally, there are only a handful of underfunded agricultural biotechnology initiatives (public or private sector) with an explicit focus on poorer farmers as their primary clients/markets. Some examples are the Center for the Application of Molecular Biology to International Agriculture; the FAO-facilitated Technical Cooperation Network on Plant Biotechnology for Latin America; the International Centre for Tropical Agriculture

Cassava Biotechnology Network; and other biotechnology networks created and managed by the CGIAR international centres. Several national Governments of developing countries have good programmes on agricultural biotechnologies, such as Mexico, Argentina, Brazil, China, India and Egypt.

19. The Commission on Science and Technology for Development will address the topic "National capacity-building in biotechnology" in its current work programme. Particular attention will be given to agriculture and agro-industry, health and environment. The theme will include the transfer, commercialization and diffusion of technology, as well as bioethics, biosafety, biodiversity and regulatory matters affecting these issues to ensure equitable treatment. In its resolution 1999/61, the Economic and Social Council also recommended that the Commission initiate a dialogue that involves the private and the public sectors, non-governmental organizations and specialized biotechnology centres and networks to raise issues concerning global development in biotechnology (see also General Assembly resolution 54/201).

20. In 1991, the intergovernmental Commission on Genetic Resources for Food and Agriculture requested the preparation of a code of conduct on plant biotechnology, with the aim of maximizing the positive effects and minimizing the possible negative effects of biotechnology in agriculture. However, the Commission has suspended work on the draft, pending the completion of the negotiations for the revision of the international undertaking on plant genetic resources. At its eighth session, in April 1999, the Commission requested that a report on the status of the draft code of conduct be submitted at its ninth session, in 2001.

IV. Assessing impacts of biotechnology on health and the environment

21. There are concerns about potential risks posed by some aspects of biotechnology. These risks fall into two basic categories: the effects on human and animal health, and the environmental consequences. Caution must be exercised in order to reduce the risk of transferring toxins from one life form to another, of creating new toxins or of transferring allergenic compounds from one species to another, that could result in unexpected allergic reactions. Risks to the environment include the possibility of out-crossing, leading, for example, to the development of more aggressive weeds or wild relatives with increased resistance to diseases or environmental stresses, upsetting ecosystem balance. There is also the potential loss of biodiversity, for example, resulting from the displacement of traditional cultivars by a small number of genetically modified cultivars, and the potential for increased crop vulnerability resulting from the possible widespread adoption of varieties with simple, monogeneic, disease resistance mechanisms. However, in principle, these latter effects are no different from those that may result from many conventional approaches to plant breeding.

22. Policy decisions taken in regard to biosafety regulations will have long-term implications for the sustainability of agriculture and food security. Many genetic engineering approaches to crop improvement arise from a lack of suitable conventional approaches to dealing with a particular agronomic problem or need. It appears that long-term negative implications for agriculture and food security can arise equally from having biosafety regulations that are either too lax or too stringent.

23. Genetic engineering approaches have considerably broadened the range of gene pools which are now accessible for crop improvement purposes. If countries expect to benefit from modern biotechnologies in their agriculture and food sectors, they will have to give serious consideration to the drafting of biosafety regulations that are tailored to meet their socio-economic needs. Biosafety regulations and standards for risk assessment need to be harmonized within eco-regions since environments are common across political boundaries.

24. The development of international norms in biosafety is essential. In 1995, the Conference of Parties to the Convention on Biological Diversity established a negotiation process to develop — in the field of the safe transfer, handling and use of living modified organisms — a protocol on biosafety, specifically focusing on the transboundary movement of genetically modified organisms resulting from modern biotechnology. After five years of negotiations, ministers and senior officials of over 130 Governments finalized a legally binding agreement for protecting the environment from risks posed by the transboundary transport of living modified organisms created by modern biotechnology, during formal negotiations to

adopt the protocol, held at Montreal, from 24 to 28 January 2000.[2] The issues of biosafety and biotechnology are also to be addressed by the Codex Alimentarius, the joint FAO/World Health Organization (WHO) Commission that determines global food standards. It has set up an ad hoc intergovernmental task force on foods derived from biotechnology that is scheduled to meet from 14 to 17 March 2000 in Tokyo.

25. Biosafety assessment requires that risks, benefits and needs be given a balanced assessment in relation to genetically modified organisms. Many opponents of plant biotechnology cite biosafety as the key risk-based issue for the more stringent regulation of transgenic organisms. Much controversy has been generated over the safety of transgenic foods.

26. It should be borne in mind that in a biological sense, the inter-species genetic modification of foods is not inherently new. Many conventionally bred crops are by any biological definition transgenic, since they contain genes or segments of chromosomes from totally different crop species. Many of the biological phenomena which are often cited as unique biosafety issues for genetically modified crops actually also occur in conventional plant breeding or other biological processes involving non-modified organisms and in wild species.

27. In the context of biotechnology risk assessment, there is a widely held scientific consensus that risk is primarily a function of the characteristics of a product — whether it is a purified chemical or a living organism to be field tested — and is not per se a function of the method of genetic modification. However, the current legal definitions of genetically modified organisms upon which most biosafety legislation is being constructed are largely process- rather than product-oriented. The scientific consensus emerging from the vast range of biosafety studies of transgenic plants is that each case should be evaluated on its own merits and hazards. Hence, biosafety decisions might differ according to the particular type of transgene, crop, environment and end use involved.

28. There is no evidence to suggest that transgenic crops or biotechnology per se would either decrease or increase biodiversity in agricultural or in "natural" ecosystems. Within agricultural systems, plant biotechnology research could be applied to either increasing or decreasing genetic diversity, depending on research objectives. With modern biotechnological methods, the use of the genetic resources from wild crop relatives may actually increase. The selective advantage that a particular genetically modified organism will confer in the agro-ecological niche in which it is applied should be considered in risk assessment.

29. In general, any risks of transgenic crops to biodiversity should be assessed relative to other non-transgenic options. Most risk assessment studies regarding genetically modified organisms fail to do comparative studies to assess each particular risk relative to the levels of risk to health and environment from other options.

30. Many naturally occurring plant proteins and compounds can be anti-nutrients, toxic or allergenic. Indeed, a significant number of crop species are toxic if not cooked or prepared properly to reduce or inactivate such compounds. There is currently no scientifically accepted evidence to suggest that transgenic foods per se are any more or less toxic or allergenic for humans than their conventionally bred counterparts. Indeed, genetic engineering approaches and other research approaches are under way to develop "functional foods" or "nutraceuticals" which would contain lower levels of allergens and toxins or higher levels of beneficial compounds than conventional foods.

31. Consumers have a definite right to information and hence choice regarding which foods they purchase or eat. However, consumer information is based on the premise that the information provided to the consumer is of utility to the consumer in making an informed choice. Labelling is increasingly perceived as necessary by both the biotechnology industry and some Governments to meet consumer concerns, and several OECD countries require labelling of transgenic foods. The United States of America requires labelling of transgenic foods that are substantially different from their unmodified counterparts, including foods that could contain a potentially allergenic compound, such as a peanut protein or glutenins.

32. Since this is a new area in which many developing countries lack technical expertise, there is need for technical assistance and capacity-building on biotechnology and on risk assessment of genetically modified organisms to allow for adequate biosafety measures to be implemented by countries.

V. Biotechnology, intellectual property rights, and the private sector

33. The global market for agricultural biotechnology products was less than US$ 500 million in 1996 but is projected to increase significantly. As a result, the past decade has seen a major increase in private-sector investment in agricultural biotechnology. According to FAO, private-sector agricultural research in the OECD countries is now in excess of $7 billion and accounts for half the world's entire agricultural research investment. As a result of recent mergers and acquisitions, there are now fewer small agricultural biotechnology companies. In some countries, antitrust enforcement policies are sometimes required for consumer protection when competition between industries is stifled because particular companies have obtained control of a market.

34. For commercial reasons, richer farmers are likely to be the main target market for most privately funded plant biotechnology research, as reflected in the crop focus of current agricultural biotechnology research, which is heavily biased towards major commercial — often export — crops, such as maize, soybean, canola, cotton, tobacco, tomato, potato, squash and papaya, rather than the food staples of poorer populations, such as millet, sorghum, cassava, sweet potato and plantains. There is a need at both the national and international levels to stimulate research and development for non-export staple crops.

35. Extremely high levels of regulation of the biotechnology sector will actually favour larger companies and act as a barrier to entry for smaller companies. Overregulation of all agricultural biotechnology could widen both the technology and income gaps between richer and poorer farmers (or consumers).

36. Intellectual property rights represent a useful means by which private investment in research and development can be promoted. However, alternative or modified incentive structures (e.g., limitations on exclusive licensing) may be more appropriate for public-sector research institutions (or for publicly funded research). Intellectual property rights related to agricultural biotechnology products and processes are being claimed by both private firms and an increasing number of public institutions and governments. The differences between different types of intellectual property rights and the issues surrounding their application to pro-poor agricultural biotechnology research have recently been reviewed for the Commission on Genetic Resources for Food and Agriculture.[3]

37. The World Trade Organization (WTO) Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement is to be tentatively reviewed by WTO in 2000. The majority of current patents and plant variety protection certificates are predominantly filed by companies from the OECD countries. It is not yet clear what impact the harmonization of intellectual property rights systems will have on the relative roles of foreign and domestic innovation in the agricultural biotechnology sector in developing countries. To a certain extent, that will depend on what models result from any international harmonization of intellectual property rights. One of the concerns that has been expressed in relevant forums is the relationship between obligations under the TRIPS Agreement, the Convention on Biological Diversity and the FAO international undertaking on plant genetic resources. It is widely considered that there is a need to develop a system that protects and ensures traditional knowledge and farming practice.

38. A key consideration for researchers will be intellectual property rights research exemptions, which refer to the use of protected materials for the purpose of certain research and product development or improvement. In the context of food security in developing countries, there may be some scope for obtaining research exemptions on use of proprietary technologies for non-commercial purposes, such as for neglected crops, non-export crops and subsistence farmers.

VI. What future for agricultural biotechnology and sustainable agriculture and rural development?

39. Expenditures on food staples typically absorb half the income of people below the poverty line. Food staples are their main source of nutrients. There is little doubt that if plant biotechnology research were applied to well-defined social or economic objectives, such as improving the food staples of the poor, it could benefit poorer rural and urban groups.

40. There remains the valid concern that the needs of poorer farmers or nations are unlikely to be a factor which favourably steers the research objectives of biotechnology research, which is dependent on private investment. At the governmental level, there are currently no policy instruments which promote the type of biotechnological research that could contribute to food and livelihood security in resource-poor situations, especially in developing countries. Long-term public-sector investment in agricultural research will be essential to address the needs of poorer farmers and consumers, who do not constitute a significant commercial market for private-sector biotechnology research and development. Increased participation by farmers and other key actors in the overall sustainable agriculture and rural development process is of vital concern. It is important to strengthen the communication among public-sector agricultural biotech research, on-farm research and farmer groups to facilitate the realization of sustainable agriculture and rural development.

41. There is a need to adopt a holistic and integrated approach in the application and evaluation of the impacts of agricultural biotechnology. Evaluation of newly engineered crops must consider biodiversity as a value; monitoring bio-indicators can help in reaching decisions about their environmental impacts. Many actions in several fields need to be developed by Governments and by international organizations to make sure that the pro-poor potentialities of agricultural biotechnologies are realized. Care should be taken that the current gap between developing and developed countries does not increase as a result of their lack of appropriate action concerning those key issues.

Notes

[1] See Per Pinstrup-Andersen et al., *World Food Prospects: Critical Issues for the Early Twenty-First Century*, 2020 Vision Food Policy Report (Washington, D.C., International Food Policy Research Institute (IFPRI), 1999); IFPRI, a member of the Consultative Group on International Agricultural Research, has also looked at the issue in G. J. Persley, ed., *Biotechnology for Developing Country Agriculture: Problems and Opportunities*, 2020 Vision Focus 2 (Washington, D.C., IFPRI, 1999).

[2] Under the Cartagena Protocol on Biosafety, Governments will signal whether or not they are willing to accept imports of agricultural commodities that include living modified organisms by communicating their decision to the world community via an Internet-based biosafety clearing house. In addition, shipments of commodities that may contain living modified organisms are to be clearly labelled. Stricter advanced informed agreement procedures will apply to seeds, live fish and other living modified organisms that are to be intentionally introduced into the environment. In such cases, the exporter must provide detailed information to each importing country in advance of the first shipment, and the importer must then authorize the shipment. The aim is to ensure that recipient countries have both the opportunity and the capacity to assess risks involving the products of modern biotechnology.

[3] For background information papers on the Committee, visit: http://www.fao.org/ag/cgrfa/docs.htm.